Work System Design
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Lecture - 03
Measurement of Productivity

Namashkar friends. Welcome to session 3 in our course on work system design and we are currently in the week 1 of our discussion. As you are aware that this is a 12-week course and we are going to have a 30-hour discussion on this topic of work system design. In the week first and second, our focus primarily is on understanding the concept of productivity why because the tools and techniques that we will learn during the course will be helpful in improving the productivity.

Productivity can be in terms of labour productivity, productivity can be in terms of the overall financial productivity, so we will be learning the tools and techniques which will help us to improve the productivity of the organization and therefore first we need to understand that what is productivity, how we can measure productivity, then we must know how to calculate the productivity, what are the objectives of productivity measurement.

We must know what are the reasons for low productivity, then what are the remedies that can be adopted to improve the productivity. Then, we will focus our attention on the various techniques which will help us in improving the productivity of an organization. As to give you an example, ergonomics is one tool which is being widely used. If you see the kind of seats that we use to sit in the buses have been greatly chased using the concept of ergonomics.

And the work place where we are working has been improvised. If you look at the studio also we have been doing courses regularly in the studio, recording different courses, the things are changing day-by-day and they are changing for the betterment, so always there is a chance for improvement, always there is a chance to improve the productivity, always there is a chance to improve the efficiency, always there is a chance to improve the effectiveness of operations being done by an organization.

So the target of our course is to learn the tools and techniques which will help us to improve the productivity of an organization as well as to improve the health, improve the safety, improve the efficiency of the workers who are working within the organization. So before going to that we must focus on the measures of productivity and in today's class or today's session within next 25 minutes we will quickly focus on the measurement of productivity.

If you remember in session 2, we have discussed the basic concept of productivity. We have seen that productivity is the relationship between the output produced to the inputs that are going into the system. So based on the input work is done on this input and finally we produce the output. So it is giving us a relationship between the output and the input. Now how we can do the measurement of the productivity.

We will see different approaches which are adopted to measure the productivity.

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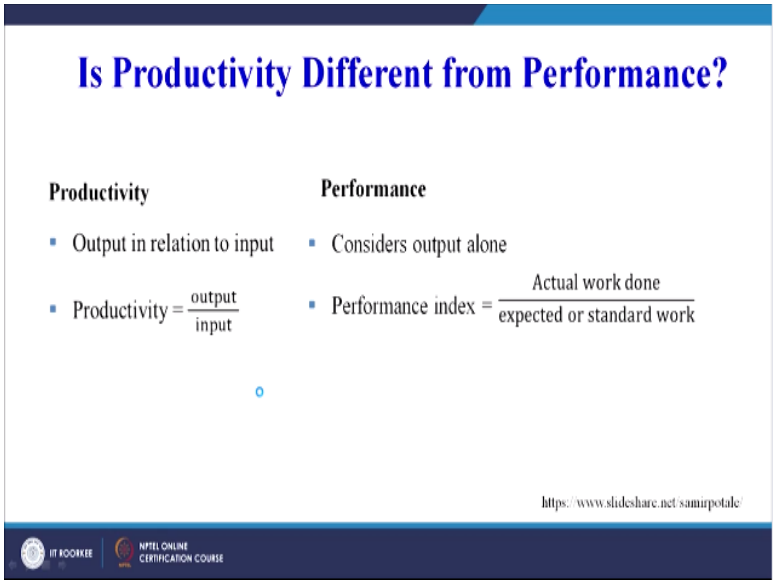

So if you see on your slide you can see how productivity is different from performance because there are different words which are used as synonyms maybe productivity and performance and efficiency and effectiveness so we must be able to differentiate among these words using a scientific logic, using a scientific definition, so on your screen you can see productivity is the relationship between the output and the input.

So output in relation to input is what is given by the term productivity. So productivity is output that we are producing/the input. For example, if we take a clerical staff working in a bank, if he or she is able to serve 10 customers per hour, we will say that the productivity of

the staff is 10 customers per hour of time. So per hour of time is the input given by the staff sitting on the seat which is serving the various banking transactions of the customers.

And he or she is able to serve 10 customers in one hour so the input is one hour of time of this staff and the output is the service given to the 10 customers. So that is maybe output/input that is basic definition of productivity but what is performance? Now performance considers the output alone whereas productivity considers both output and input that is output in terms of input.

Similarly, performance index is given by actual work done/expected or standard work that must have been done. So the performance index is you can say indicator that how the person has performed his duty. Suppose a staff was given a task to write 10 applications in one given day or in a shift of 8 hours and he or she writes only 4 applications in the given day or the 8 working hours.

So based on that what was expected and what has actually been performed by the worker will give us the performance index. So we can see performance index is given by the actual work done/the expected or the standard work that was expected out of the worker. Now let us try to understand quickly with the help of an example how productivity is different from performance.

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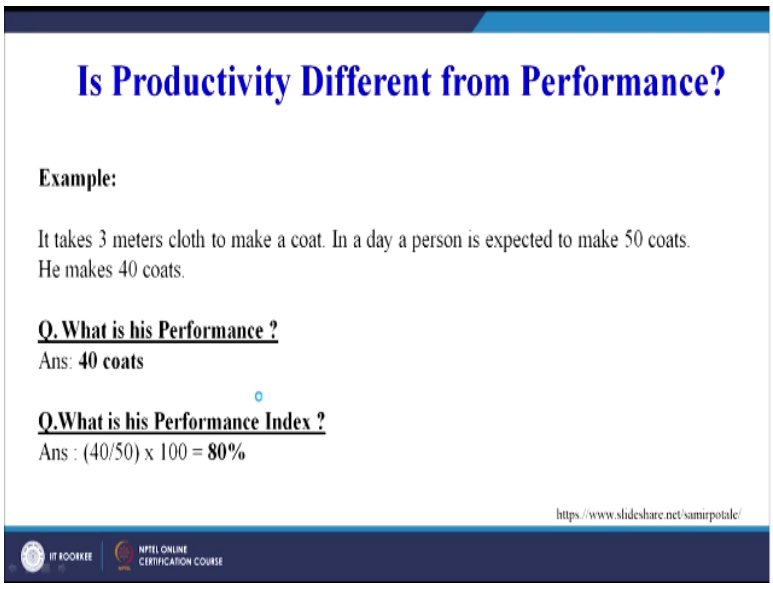

Now the problem is that it takes 3 meters' cloth to make a coat. In a day, a person is expected to make 50 coats, so what is expected that a worker must be able to make 50 coats. Now he

makes 40 coats, so if we say what is the performance? The performance is he has been able to make 40 coats in a day. What is his performance index? Now performance index if you remember is given by it is given by the actual work done/the expected work done or expected or standard work to be done.

So how much he has produced, 40; how much was expected in a day, 50. So the performance index is 40/50*100 that is 80%. So this is you can say the difference between the performance and productivity. If we have to calculate the productivity, we will have to see that what are the various inputs going into this manufacturing or tailoring of coats and then based on how many coats have been produced we can take a ratio of the output to the input then we will say that we have calculated the productivity of the process of coat making.

So we can see that what is the difference between productivity and performance. Then, coming on to the efficiency versus productivity.

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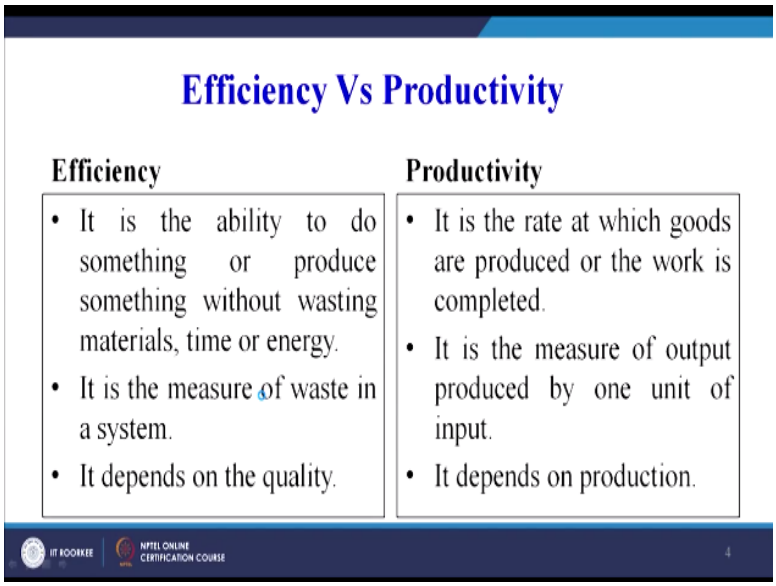

So we also need to differentiate among the words efficiency and productivity, which is very important and many times the learners are little bit may be in a hazy state of mind when they have to differentiate between efficiency and productivity. So let us see with the help of few bullet points that what is the difference between the 2. Efficiency you can see it is the ability to do something or produce something without wasting materials, time or energy.

So it is the ability to produce something without much wastage. Now suppose we have produced 10 different parts, 7 of them are good quality, 3 of them are poor quality or are

considered as a waste, so we will say that what is the efficiency, efficiency of production is may be 7 parts/10 where that is the total number of parts produced. So maybe that is you can say we are considering the wastage also here.

It is the measure of waste in a system. It depends upon the quality as I have already told 10 produced, 3 defective, 7 okay or 7 may be as per the standard specifications from there we will calculate our efficiency but productivity how we will calculate maybe for the 10 parts produced we will see what is the output, output is 10 parts whether they are defective or they are not defective we will say 10 parts produced.

What is the input used? or what is the input given into the system to produce these 10 parts? so that will be another maybe it will come in the denominator. So in the numerator as we have seen productivity is output/input so output will be number of parts produced, in the input we will have all the may be inputs that have gone in order to produce these 10 parts and thereby we will calculate the productivity.

So productivity is the rate at which goods are produced or the work is completed. It is the measurement of output produced by 1 unit or per unit of input. It depends upon the production, so we can see that we are not considering the wastage or the efficient utilization without wasting materials, time or energy. So we are considering in productivity what is the total input going into the system, what is the total output produced by the system and that will give us the productivity.

So we can say that in order to improve the productivity what we can do mathematically. Mathematically, what we can do, we can try to increase the output keeping the input same. We will say productivity has improved or we can say the output remains constant, we reduce the input then also we will say the productivity has improved or the third option can be we can increase the output, we can increase the input also but the proportionate change in output is much more as compared to the proportionate change in input.

So mathematically if we write productivity=output/input, we can mathematically see that what can be the various options of improving our productivity. Similarly, for efficiency also we can see that how we can reduce the waste, how we can do the better utilization of the materials, the time, the man hour and try to improve the efficiency of the system. So

efficiency focus on the minimization of the waste and productivity focus on the maximization of the output with in relation to the input that is given to the system.

So once again quickly I will read the first 2 sentences for each so the things becomes absolutely clear to the learners. Now efficiency it is the ability to do something or produce something without wasting materials, time or energy. So something can be any product or service. Productivity, it is the rate at which goods are produced or the work is completed, so in context of the inputs given to the system.

Now why productivity is important? I have already told the first target was to differentiate among the various words that I will advise the learners, I will suggest that you look for various other information sources, knowledge sources and try to further maybe fine tune your understanding of these different words, the 3 or 4 different words I am just giving you as an assignment that you can try to understand the 4 different words, although we are discussing productivity, performance, efficiency and effectiveness.

So you must be clear with the definitions, with the difference among the 4 different words. Sometimes in interviews it is definitely asked what is the difference between efficiency and effectiveness, sometimes somebody may ask what is the difference between productivity and efficiency, sometimes what is the difference between productivity and performance. So you must be able to clear scientifically that what is the difference between these different words.

Now since our focus is more on productivity, so we are going to see that why productivity is important?

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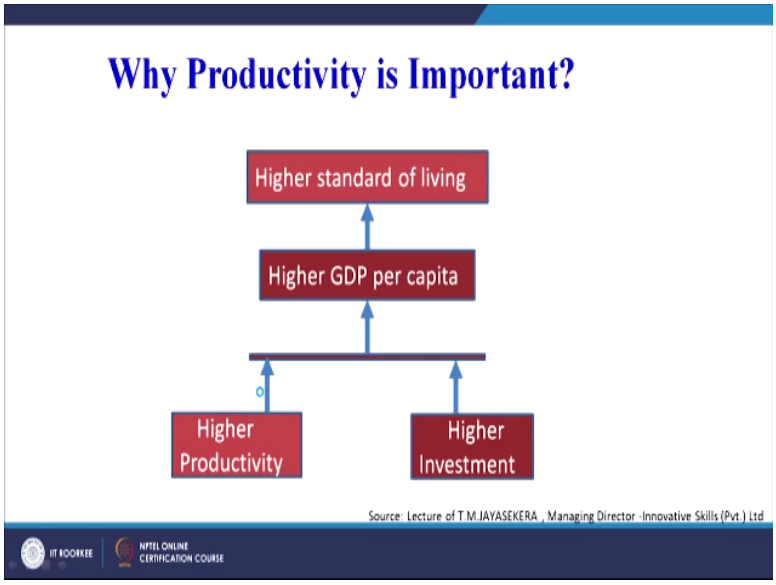

You can see productivity is important because higher productivity leads to higher GDP per capita and then higher standard of living. So if we are able to convert our inputs into tangible outputs in a much better manner without may be doing any blunders or without creating any problems if all our inputs are getting converted into tangible outputs, we will say our productivity is good.

And the rate at which we are converting into output that also increases, then we will say the productivity is good and if we are very, very productive in terms of our time, in terms of the resources that we have, the overall development of the country will definitely take place. So people will have better standard of living, so it is not only that it is going to help us medium or a small scale organization, it can help the whole country to improve as well as to increase or improve the standard of living of the various people or the various citizens of the country.

Now if we are able to increase the productivity for as I have told mathematically you can just remember that we keep all the inputs same but with the same inputs we produce more output, so if with the same input we are producing more output the benefits that the company or the organization or the enterprise that it will accrue will be transferred to the workers also, to the people also, you can say work force to the human resource of the organization.

So the benefit of increased productivity are for the workers, obviously it is for the organization also. When the organization is making profit, people are happy, they are also getting their wages or the bonus. The overall country will also be benefitted as well as it will

be able to satisfy the consumers or the customers as well as the society in general. So the overall economic development will take place if the productivity is higher.

Now what are the factors that will influence? We have I think discussed at length that what is productivity, what is performance, then we have tried to differentiate efficiency and productivity, we have also tried to see that if we have good productivity for all our organizations, overall development of the country will take place, society will be benefitted but then what are the factors that affect productivity.

Because in order to improve the productivity we need to focus on some key areas where changes may be done in order to improve the productivity because if it has to happen on its own then maybe it must have happened by now, it means that there are some key areas, key factors which we must address in order to improve the productivity.

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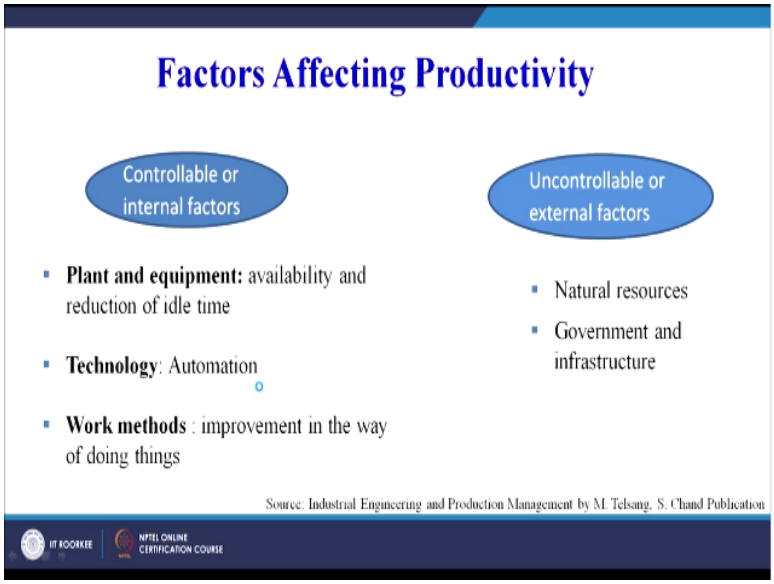

So there are controllable or internal factors and there are uncontrollable or external factors. Now what are the controllable or internal factors where each and every company must focus in order to improve their productivity that is the plant and equipment, availability and reduction of idle time, so we must try to utilize our resources to the maximum possible extent.

And we will see when we will see the man machine chart, the operations chart, the flow diagrams that whatever is going to come in the method study we will see that how we can calculate the idle time and how we can try to maximize the utilization of our machines,

equipment and people in order to improve the overall productivity of an organization. So first focus is the controllable parameters or the controllable factors.

And that focus on the plant and equipment within the organization and we must focus on improving the utilization of our plant and equipment. Then, technology many times we will see there are some repetitive operations happening in the company. So there if we are able to do automation of the operations, the productivity may improve work methods that is improvement in the way of doing things.

If you see that workers may be doing a particular task for the last 10 years in a particular manner or in a particular sequence of operations or in a sequence of steps that may not be the best way of doing that operation or doing that procedure. Then, we can always think that how we can design a better method of doing the same job which is more effective, more efficient as well as more safe for the worker and the worker also feels happy doing the same job using a different set of steps.

So controllable parameters are plant equipment, technology, work methods that a person is going to adopt. The uncontrollable parameters are the natural resources, government and infrastructure also sometimes rules and regulations, various policies that are there which are beyond the control of an organization, all those come under the uncontrollable or external factors.

So you can see that we need to focus on a certain set of parameters if we want to improve the productivity of our operations as well as of our organization.

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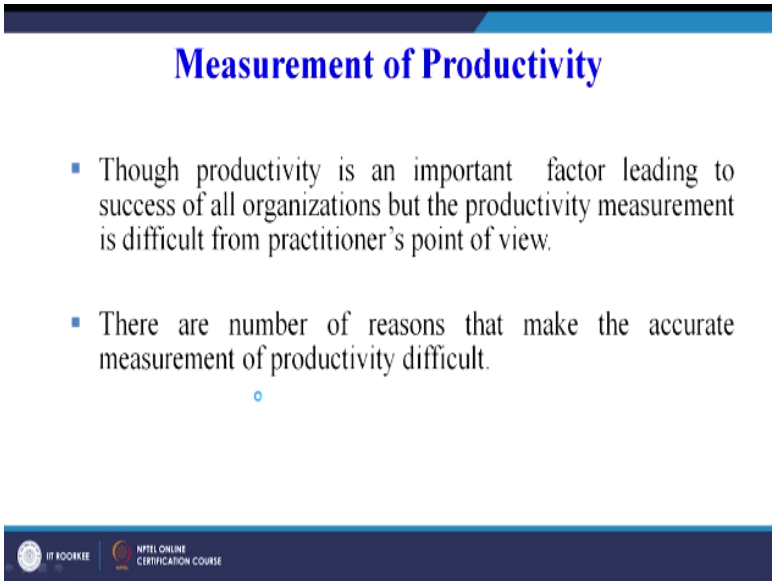

So measurement of productivity though productivity is an important factor leading to success of all organizations but the productivity measurement is difficult from practitioner's point of view. So from subjectively or if we say qualitatively all of us will agree that we must try to improve the productivity of our organization but in order to measure the productivity or in order to calculate the productivity of an organization, it is sometimes a difficult task.

It is not may be impossible but it is slightly cumbersome because we need to add up all the inputs and some of the inputs that go into the system may not be tangible in terms of quantified numbers or may not be tangible in terms of numbers sometime, there may be qualitative inputs that are going into the system which may not be able to quantify. Then, sometimes it may so happen the output that we are producing may also not be tangible.

For example, various social schemes done by or initiated by the governments. So these social schemes may lead to improvement in the economic status of various levels of society or may be various people among the society but the outputs may not be tangible which may not be explained quantitatively.

So therefore measurement of productivity that this much input, this much impetus, this much financial money was thrust into the market and this has led to this much improvement in the economic well-being of the society, sometimes it is difficult to establish but if we take example of a particular organization then may be the inputs that are given maybe quantifiable, may be quantified.

And then they can be checked in relation to the output produced that this much input has produced that much output and then the productivity can be compared. We will see that why do we need to measure the productivity that is also one of the slides today. So measurement of productivity it is a challenging task, I am not saying it is not possible, it is always possible, it is done by the various companies but sometimes in case of a combination of qualitative and quantitative inputs and output, it becomes a slightly challenging task.

There are number of reasons that make the accurate measurement of productivity difficult which I have already explained.

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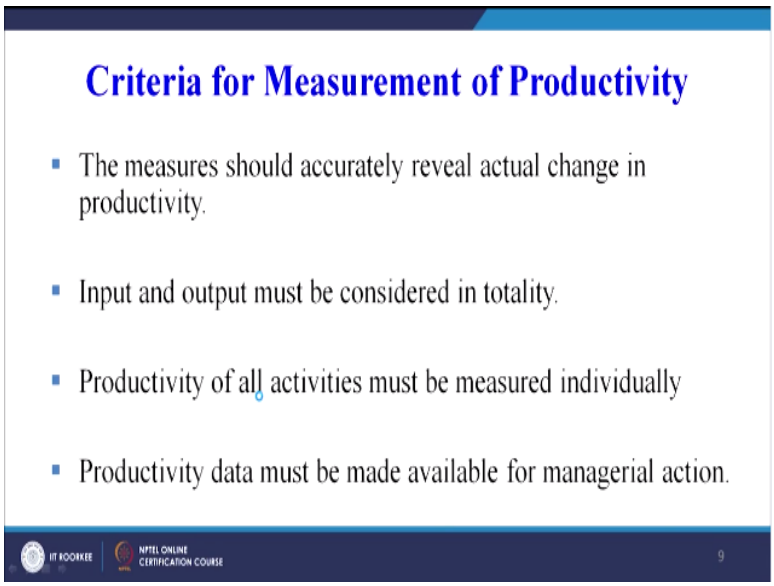

Now what is the criteria for measurement of productivity, the measure should accurately reveal the actual change in productivity. So it may be objective in nature, it may be quantifiable that is the meaning of the first point that they should accurately depict the change in productivity. Input and output must be considered in totality that is we must consider total input going into the system and the total output produced by the system.

Productivity of all activities must be measured individually. Then, productivity data must be made available for managerial action. So this is you can say the criteria for measurement of productivity that it must be objective as far as possible, it must be in totality as far as possible and then whatever measurement we are doing must be readily available for managerial action, it must be an actionable thing, it must be representing some data, it must produce an output which is actionable based on that a managerial action may be initiated.

So this is the criteria for measurement of productivity. Now what are the objectives of productivity measurement?

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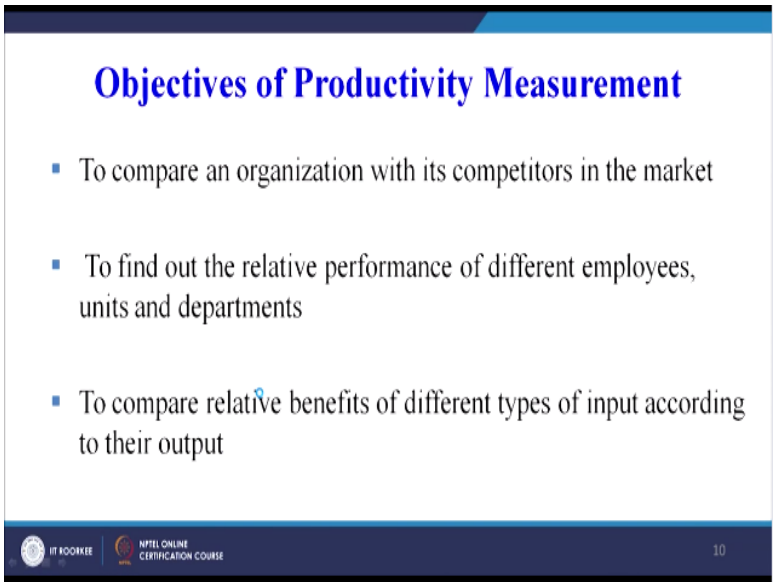

Now I have already told that how the productivity measurement is going to help us. It will help us to compare an organization with its competitors in the market. So maybe there are 2 companies, suppose company A and company B or organization A and organization B. Now A may like to do these exercise of productivity measurement by checking that how much input is going and how about output they are producing or how much output they are producing.

And then benchmark are compared their performance or productivity with organization B that how much input organization B is giving and what is the output they are producing. So if maybe somehow there is a lack in the output in part of organization A, they must look for causes, reasons as well as remedies for improving their productivity. So productivity measurement or productivity you can say values will help our organization to compare our output as we compared to the competitors.

Then, to find out the relative performance of different employees, units and as well as department. So it can act as competitive criteria among the various departments, various units or to go down to further level among the various employees also that how much time may be for an employee we can say one of the inputs can be the time given by the employee in the organization.

So how much time the employee has given and what is the output he or she has produced. So the productivity measurement will help us to compare among the various departments, various units or the employees of an organization to compare relative benefits of different types of input according to their output.

So may be different inputs can be compared that if that this much input we are giving to the system what is the change in the output and maybe we can see that there can be a combination we will see in our further slides or maybe in the further presentations that when we give different types of input we have to consider the productivity in totality. In totality means total output/the total number of inputs going.

So we can see that we have a choice to give impetus to a particular input, we can see if we give this much input or we change this input what is the change in the output or maybe if we change the next input what is the change in the output, so if you compare relative benefits of different types of inputs according to their output that is also one of the reasons why we must measure the productivity.

Now there are different approaches in productivity measurement. Quickly, we will go through these approaches.

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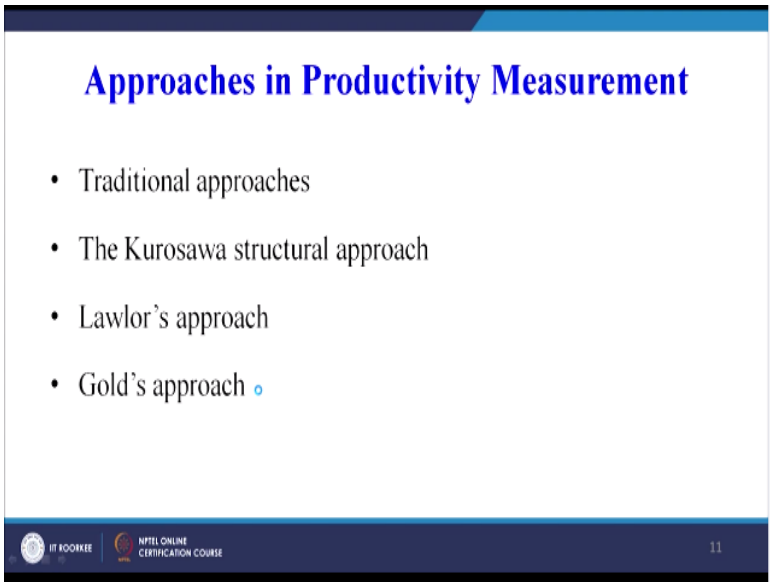

So there is a traditional approaches, the Kurosawa structural approach, Lawlor's approach and Gold's approach.

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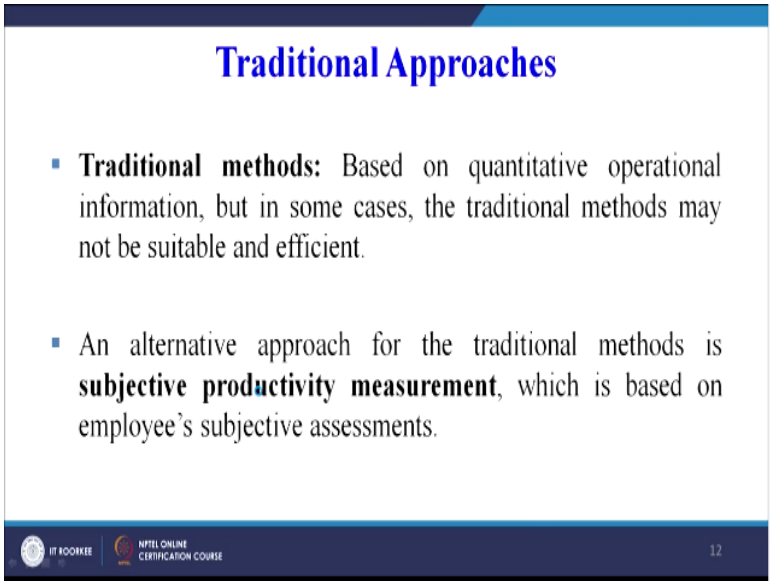

So quickly we will see these approaches and then we will wind up for today. Traditional methods are based on quantitative operational information but in some cases, the traditional methods may not be suitable and efficient. An alternative approach for traditional methods is subjective productivity measurement, so you can see the traditional methods are based on quantitative operational information.

And subjective methods are based on you can see employee's subjective assessment or subjective means more on qualitative side, quantitative is traditional method. Subjective productive measurement is based on the employee's assessment, so may be it may give us qualitative information in terms of productivity, improvement or productivity decrease but in case of traditional method, we will rely more on quantitative operational information.

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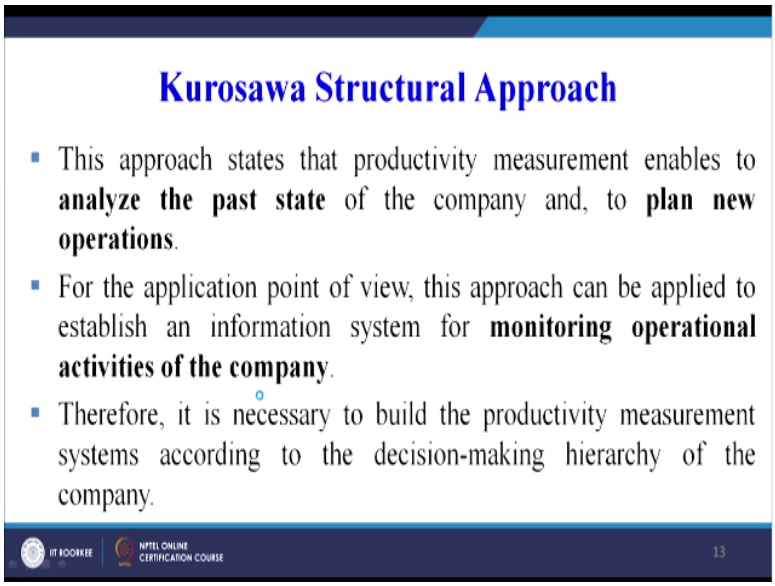

As far as the Kurosawa structural approach this approach states that productivity measurement enables to analyze the past state of the company and to plan the new operations. For the application point of view, this approach can be applied to establish an information system for monitoring operational activities of an organization. Therefore, it is necessary to build the productivity measurement systems according to the decision-making hierarchy of the company.

So we can see there are few things which we have highlighted in this particular approach. First is analyze the past state, second is then based on that we can plan the new operations. Similarly, for the application point of view how we will apply this approach, this can be applied as an information system for monitoring the operational activities of an organization.

So each and every activity will be monitored and seen that how it was done earlier, what are the changes being incorporated and how the future planning can be done based on changes that we are doing today. Therefore, it is necessary to build the productivity measurement systems according to the decision making hierarchy of the company. So for different levels of hierarchy, hierarchy in the company means the organizational structure.

You should have a clear set of productivity measurement systems, so that each and every activity is accounted for and the productivity is measured at different levels. Then, there is Lawlor's approach.

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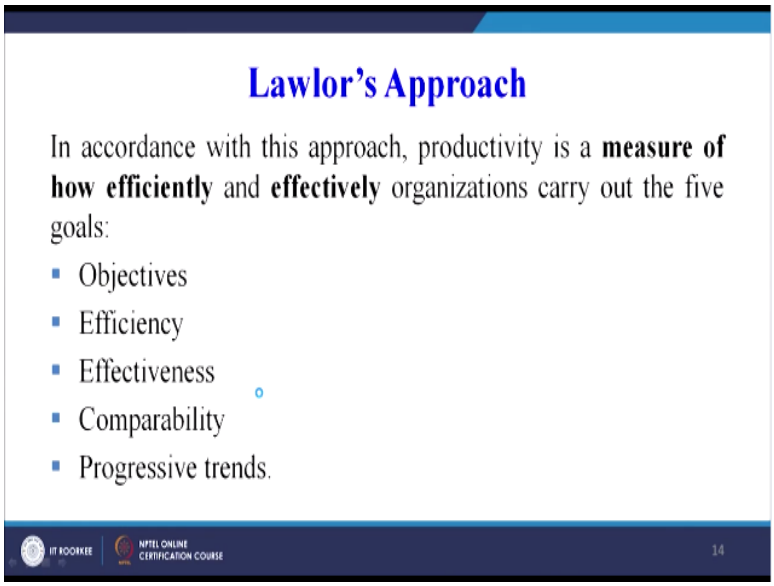

The Lawlor's approach in accordance with this approach, productivity is a measurement of how efficiently and effectively organizations carry out the 5 goals. So Lawlor's approach is you can say dependent on the 5 goals, so it is taking into account the 5 goals that how efficiently and effectively the organization is achieving the 5 goals. So in accordance with this approach productivity is a measure of how if efficiently and effectively organization carry out the 5 goals.

That is what are the objectives, how efficiently the inputs are converted to outputs, what is the effectiveness that is how what is the whether the company is following the right path, right direction or not whether comparability and the progressive trends. So basically the 5 goals are taken into account, which are there on your screen. Objectives, efficiency, effectiveness, comparability and progressive trends.

So if each and every goal is satisfied we can say the company is going to be making profit or the productivity of the company is good.

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Friends let us now take the Gold's approach, in Gold's approach emphasizes on the rate of return and attributes profit to 5 major elements of performance. Now in previous case, we have seen that there are 5 if you go to the previous slide, we can see that how efficiently and effectively the 5 goals are maybe you can say taken care by the organization that is the objectives, efficiency, effectiveness, comparability and progressive trends.

Similarly, now in Gold's approach also there are 5 major elements of performance and we have to see that how we are able to achieve or how we are able to focus on these 5 major elements of performance. That is the price of the product, the unit cost of the product, utilization of facilities available within the organization, productivity of these facilities and allocation of capital resources of the organization between fixed and the working capital.

So we can see that we are focusing on rate of return and attributes profit to these 5 major elements of performance. So it is seen that if we focus on these 5 elements, we will be able to make profit and if we are able to make profit, we can say that we are productive but that is also not an absolutely correct statement which may be a subset of the overall productive measurements.

It can be just one criteria based on which we can say yes profitability can be somehow may be loosely related to the productivity but that may not be correct as we have seen I think in the second lecture, we tried to understand the difference that although we may be making profit but we may not be very, very productive or the productivity may not be that high. So we have seen that as per the Lawlor's approach what must be the focus area, as per the Gold's approach what must be the focus area.

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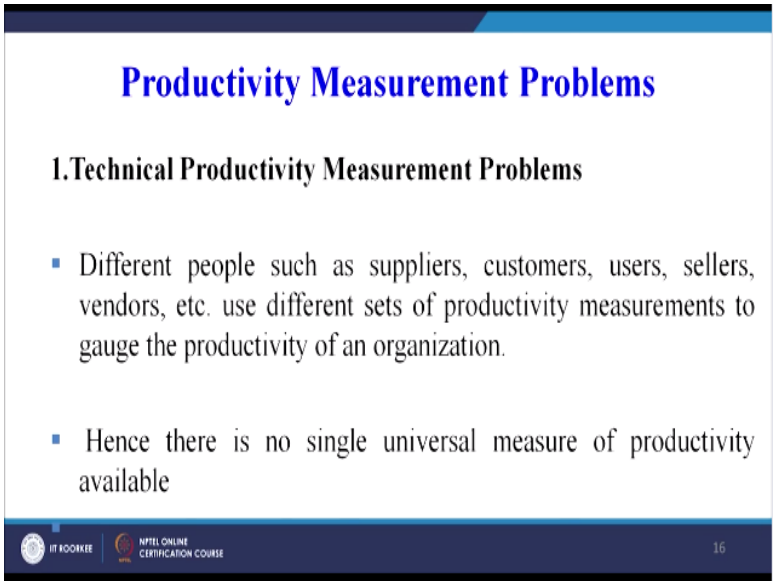

And then we can see that what are the problems with productivity measurements that is technical productivity measurement problems like different people such as suppliers or customers or users or sellers or vendors use different sets of productivity measurements to gauge the productivity of their organization. So there is no uniform set of productivity

measurement tools which are adopted by each and every stake holder in the overall supply chain.

So across the supply chain, different people or different vendors use different set of productivity measurement, so it makes the problem slightly complicated. Then, there is no single universal measure of productivity which is available.

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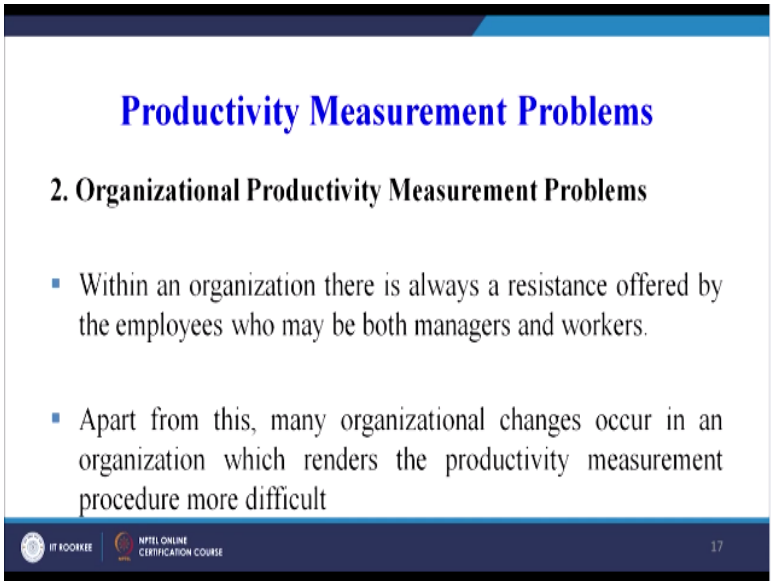

Then, the organizational productivity measurement problems that is within an organization also there is always a resistance offered by the employees who may be both the managers or the workers apart from this many organizational changes occur in an organization which renders the productivity measurement procedure more difficult.

So if we see the major problems that is one is across the various organizations which are working together for producing a product that is vendor that is people who are making different parts for the organization or people who are selling the parts made by the organization, so the complete supply chain different stake holders are using different productivity measurement tools and techniques.

Then, within the organization also sometimes workers and managers are also resistant to the productivity measurement techniques because sometimes people feel that it will lead to hard work. If you remember in the previous session, we have already highlighted that people fear productivity measurement because they feel that they will have to work hard if the

productivity measurement is done and they will be given may be higher targets of performance in case of the number of parts or products they produce in per unit time.

So therefore there is an internal resistance within the organization also for productivity measurement. So with this I conclude session 3 of our course on work system design and we may not have been able to completely understand the various approaches or the intricacies of various approaches but at least we have been able to highlight that there are different approaches for productivity measurement.

We have tried to highlight what are the objectives of productivity measurement as well as we have understood that what are the various problems related to productivity measurement. In our next session, we will take forward our discussion on this topic and by the end of this week I think all our doubts related to productivity measurement will be cleared and if still we have some more doubts we can discuss over the discussion board. Thank you.